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PRODUCT EVALUATION 86-18
JOINT SEALANT STUDY

Construction Report

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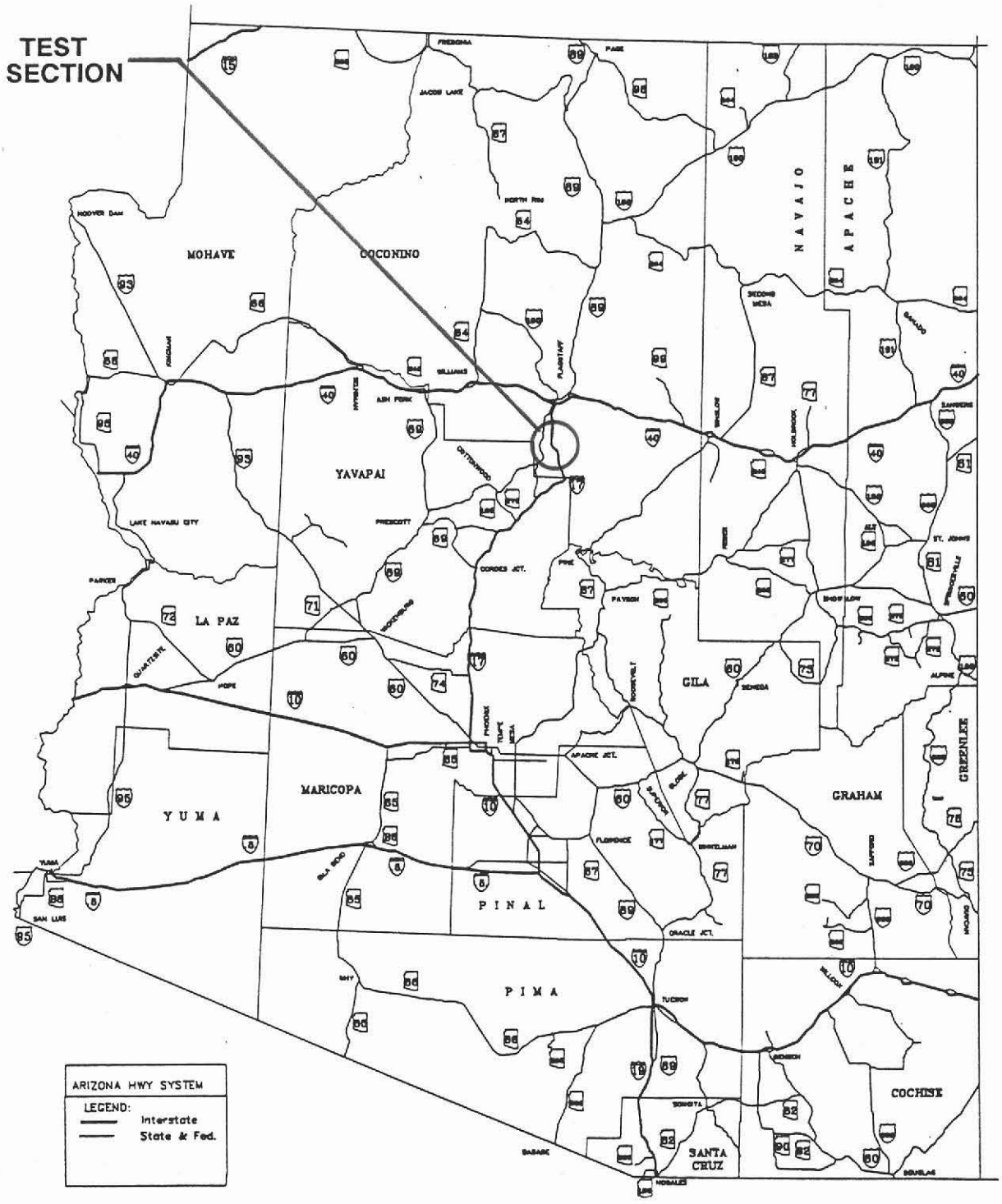

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CONSTRUCTION REPORT

JANUARY 7, 1987

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16. ABSTRACT

ADOT has approximamtely 550 lane miles of jointed portland cement pavement under its jurisdiction. The current practice is to saw and seal the joints at the time of construction and reseal the joints under a rehabilitation project. ADOT does not specify a performance criteria for joint sealant.

To evaluate the performance of currently available products, a 0.7 mile test section was constructed on I-17 near flagstaff. The test section, constructed on the southbound roadway from milepost 330.5 to 331.2 compared two silicones , Dow Corning 888 & Superseal 888, and three hotpours Allied-Koch 9001, Craftco Roadsaver 231 and W. R. Meadows SOF-SEAL.

The sealants were placed in July, 1986 by Change Order on project IR-17-2(104). This project consisted of resealing 26 miles of plain jointed concrete pavement constructed in 1974. A total of two hundred transverse joints extending across the entire roadway were sealed. The sealants were placed in a specified pattern alternating one product after another until forty joints of each material had been placed (i.e. within any five joint interval all five products were placed).

The sealant perfermance will be monitoried semi annually for a period of four years with cores obtained after one, two and four years.

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I. INTRODUCTION

ADOT has approximately 550 lane miles of jointed portland cement concrete pavement under its jurisdiction. Traffic patterns vary from 8,400 ADT on a rural four lane interstate highway to 117,000 ADT on an urban six lane freeway system. Truck traffic ranges from 36% on interstate rural highways to 10% on urban freeways in Phoenix.[1]

Climatic conditions in Arizona impact joint sealant performance dramatically. The average low temperature in Arizona's high country (above 6,000 foot elevation) is 15°F during January while the average high temperature is 80°F, in July. The average low temperature in the desert environment (1,000 foot elevation) is 65°F in January and the average high temperature is 115°F in July. Average rainfall varies from 19 inches of precipitation near Flagstaff to 7 inches of precipitation in the Phoenix area.

Not only does a joint sealant have to contend with large temperature variations in regard to flow considerations, it must also contend with stresses associated with slab movement due to frost heave and temperature changes. No one sealant may be capable of meeting the extreme climatic conditions experienced on Arizona's highways.

The Arizona Department of Transportation installed a test section in July, 1986, to address the performance of joint sealants in the Arizona high country under a joint resealing project. The test section will be monitored for a period of four years. The Department does not currently have a performance criteria for joint sealants. Results of this study will be used to aid the Materials Section in determining which types of joint sealants are appropriate for joint resealing projects in the high elevation regions.

II. LOCATION OF TEST SECTION

An advertisement for bid, IR-17-2(104), was let March 28, 1986, to reseal 26 miles of plain jointed portland cement concrete pavement on the southbound lanes of I-17, south of Flagstaff (Figure 1). The joint sealant selected for the resealing project was Superseal 444, a hot-pour material produced by Superior Products. A copy of ADOT's joint sealant specifications for this project is included in Appendix A.

The test section per change order #4 is located between MP 330.5 and 331.2. MP 330.5 is at the crest of a hill and in the transition of a 0.052 feet per foot superelevation. The elevation of the test section is approximately 6,700 feet.

The original project, I-17-2(35), was built in 1974. The eight inch thick, 24 foot wide slab, was constructed with eight inches of portland cement concrete pavement over six inches of portland cement treated base. Contraction joints were designed to be at 17, 15, 13, 15, 17 foot spacings. Actual spacings and current condition of the test section are documented in Appendix B. Joints are on a 6:1 skew with an original saw cut of 1/4 the pavement thickness (two inches). The original joint sealant material was Superseal 444. (Figure 21)

III. DESCRIPTION OF SEALANTS

There were five joint sealants selected for the study: Allied-Koch 9005, Crafco Roadsaver 231, Dow Corning 888,Superior Products Superseal 888, and W.R. Meadows SOF-SEAL. Dow Corning 888 and Superseal 888 are 100% silicone sealants. W.R. Meadows SOF-SEAL and Allied-Koch 9005 are asphalt based materials and Roadsaver 231 is an asphalt-rubber based material.

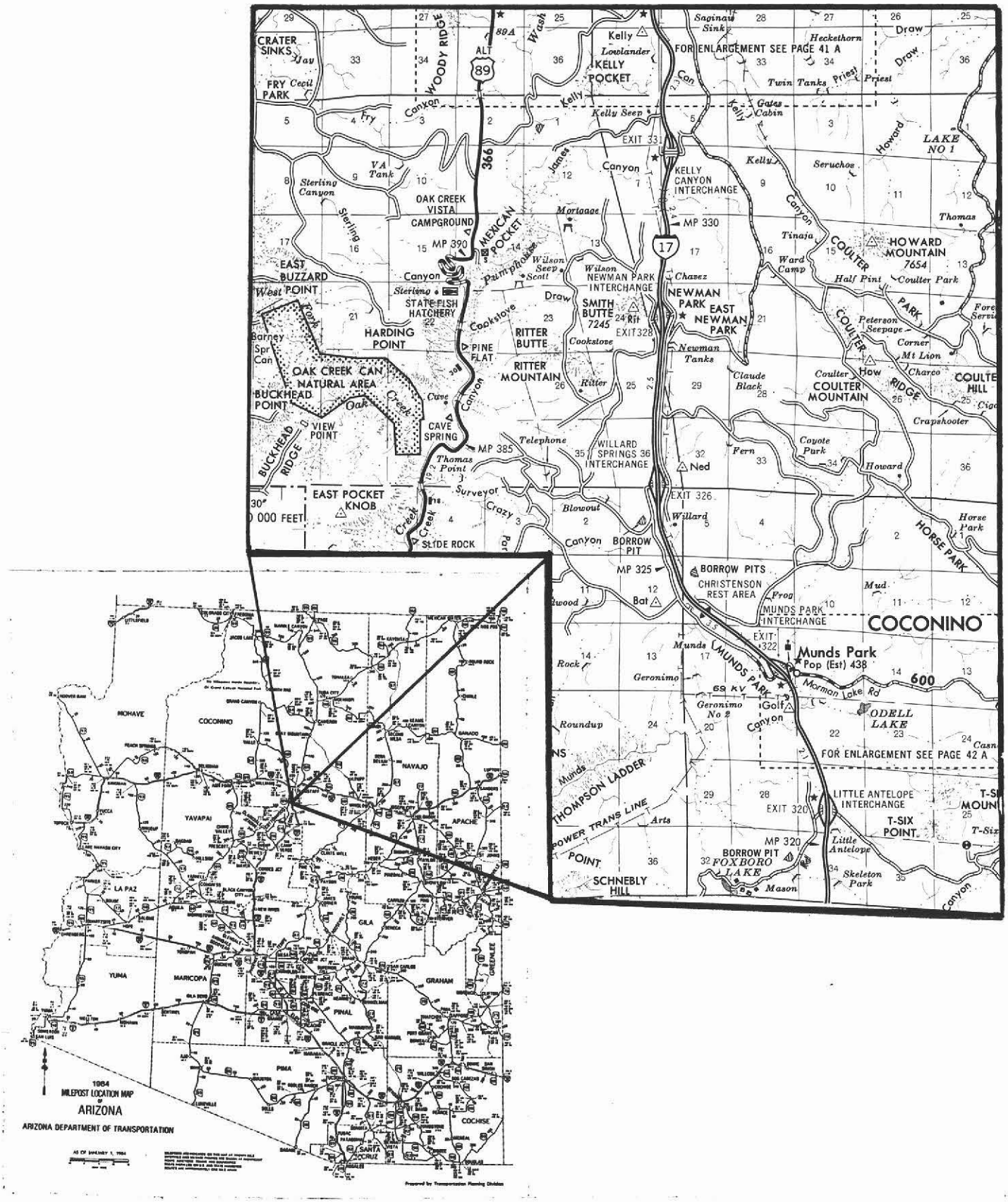

Figure 1- Location of Test Section

The silicone products are placed at ambient temperature, while the asphalt and asphalt-rubber products are placed at 360°F to 380°F. A copy of each material description and specifications is included in Appendix C. The silicones meet Federal specifications SS-5-00230C and SS-5-001543A while Allied Koch meets ASTM D3405 , Roadsaver 231 meets modified ASTM D3405, and SOF-SEAL meets ASTM D3407 for low modulus sealants. A copy of Superseal 444's description and specification is also included in Appendix C.

The estimated material cost, per 100 lineal feet of joint, for each product on this project is:

PRODUCT	$/ 100 '
Allied- Koch 9001	13
Crafco Roadsaver 231	22
Dow Corning 888	69
Superseal 888	67
W. R. Meadows SOF-SEAL	26

IV. CONSTRUCTION REPORT

The placement pattern for the five joint sealants was selected to minimize any biases and to be statistically valid. A total of 200 joints were sealed in the test section, 40 joints for each material. The sequence of placement was A, B, C, D, E, A, B, C, D, E, and so on, where A is Dow Corning 888, B is Superseal 888, C is Allied-Koch 9005, D is Roadsaver 231, and E is W.R. Meadows SOF-SEAL. Four of the products were placed in a two-day period: July 8, 1986, and July 9, 1986. The fifth product, Superseal 888, was placed July 14 and July 25. The average high temperature for each day's placement was approximately 76°F,and the average low was approximately 48°F.

The placement of A, B, C, and E was performed by the contractor, Conseal of Layton, Utah. Material D was placed by Robert Rutherford, a field representative of Crafco, using a Crafco EZ Pour 50 Melter. All joints were sawed to a depth of 2 inches and a 1/2 inch nominal width by the contractor. Actual joint width was closer to 3/4 inches. All joints were sand blasted and air-blown by the contractor. (Figure 3) The backer rod was Hercules XL, a 7/8 inch closed cell polyethalene material. All joints utilized the same backer rod; however, different depths were used for different products. The backer rod was placed with steel wheels set to the necessary depth. (Figure 4)

A. DOW CORNING 888

The Dow Corning 888 silicone was placed in a two day period. On July 8, 40 joints in the passing lane and 27 joints (beginning at MP 330.5) in the driving lane were placed. The remaining 13 joints were placed on July 9.

After the joints were prepared the backer rod was placed approximately 1/2 inch from the top of the slab. The silicone was supplied in five gallon buckets and placed by an air driven pump. After placement, it was immediately tooled with a rubber hose on the end of a broom stick. The tooling was necessary to ensure that the sealant was below the surface of the joint. Figures 5, 6, and 6 are photos of typical silicone joint sealant placement. A four man crew was used to place the material: a driver, an operator for the injection, a tooler, and a clean-up person.

No major problems were encountered during the Dow Corning placement. The technical representative was satisfied that all joints were placed in the proper manner with the exception of the first three joints in the passing lane at MP 330.5. These joints still had residue of the previous sealant in several locations. The technical representative stated that he could not guarantee adhesion in those

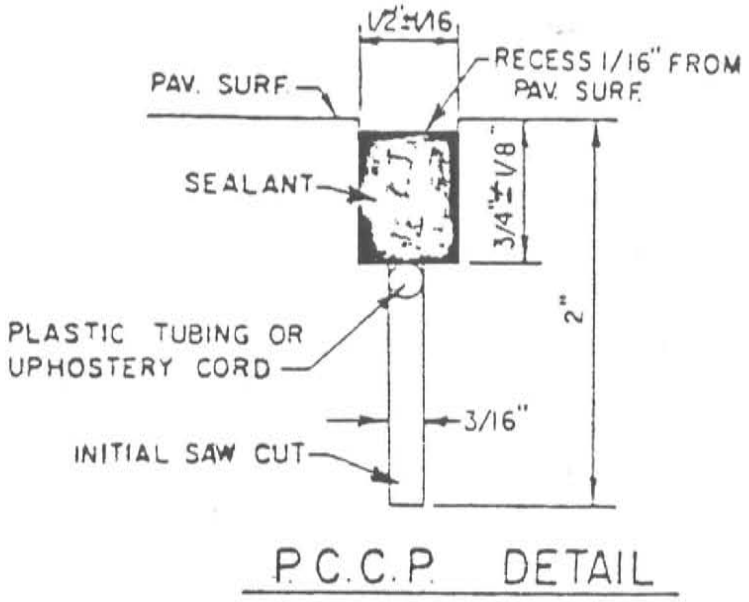

Figure 2- Original Pavement Joint Detail

Figure 3- Sand Blasting and Blowing Joints

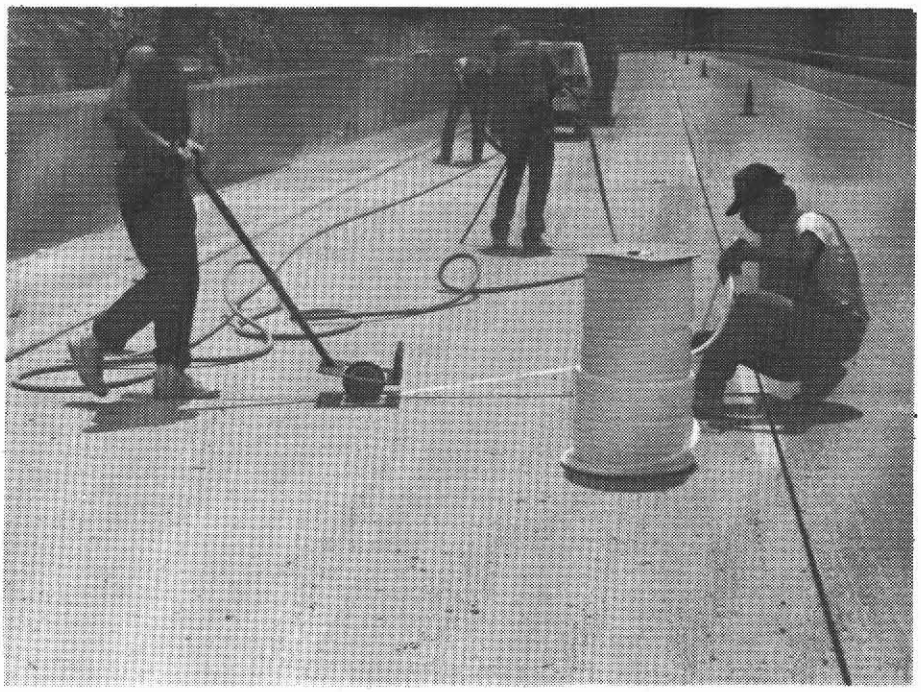

Figure 4- Placing Backer Rod

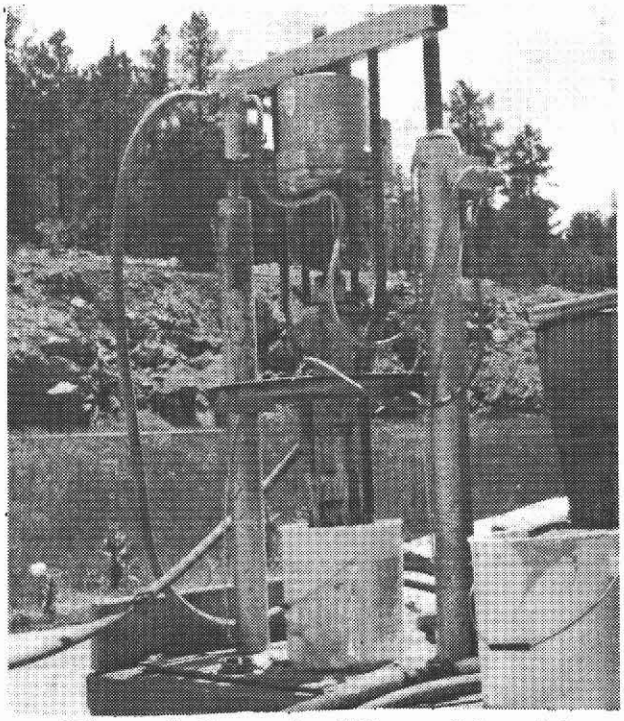

Figure 5- Pump for Silicone Material

areas. The contractor's representative stated that based on his experience the sealant would hold. The joints were, therefore, sealed with the silicone in order to determine the effectiveness of the adhesion to an improperly cleaned joint.

B. SUPERSEAL 888

Superior Products was unable to supply their material in time for the two-day project. The Superseal 888 product was placed on the 14th of July in the passing lane and on the 25th of July in the driving lane. The equipment and installation procedure was the same as for the Dow Corning 888. Prior to placing the product, the pump had to be purged, so as not to contaminate the material with the previous Dow Corning 888. Figures 5, 6, and 7 are photos of typical silicone joint sealant placement.

Superior Products failed to provide a technical representative during the placement. They had been given an opportunity to provide a representative. Frank Gauss, president of Superior Products, stated that the contractor CON-SEAL, had extensive experience placing Superior Products 888 and was confident that the material would be properly installed.

No problems occurred during the placement of Superseal 888. The product performed much like the other silicone except that it did not tool as easily. The contractor had to make more passes over the joint in order to make it neat and get it below the surface.

C. ALLIED-KOCH 9005

Allied-Koch 9005 is a low modulus, hot-pour asphalt based material placed at 365^{O}F. Both the driving lane joints and the passing lane joints were sealed on July 8, 1986. This was done in order to clear the pot at the end of the day and use the same pot for the W.R. Meadows product the next day.

After preparing the joints the backer rod was placed 1-1/4 inches below the top of the slab. The material was heated in a melting pot until the temperature reached 370^{O} to 380^{O}F. The crew consisted of a driver and an applicator. Figures 8 and 9 are photos of typical hot-pour placement.

The Allied-Koch 9005 exhibited a great deal of flow on the .052 foot per foot superelevated horizontal curve. Also, a large number of bubbles were observed immediately after placement. It was visually estimated that there were two to three bubbles per lineal inch.

D. CRAFCO ROADSAVER 231

Roadsaver 231 is a hot melt material which is heated to 380^{O}-400^{O}F for placement. Three joints in the passing lane (MP 331.2) were filled on July 8th before an equipment failure stopped the operation. The balance of the joints were sealed on the following day, July 9.

The placement of Crafco 231 was basically the same as the placement of the Allied-Koch. The depth of the backer rod was 1-1/4 inches and the material was heated to 380^{O}-400^{O}F and poured at 365^{O}F. Two people were required for the Crafco operation: a driver for the vehicle, and an operator for the pot. Figures 8 and 9 are photos of typical hot-pour placement.

The material did not exhibit the same flow characteristics as the Allied-Koch 9005 and SOF-SEAL materials. The Roadsaver 231 material appeared stiffer and, therefore, a more uniform depth of sealant was evident in the superelevated portions of the curves. Air bubbles were present immediately after placement of the sealant - approximately three bubbles per lineal inch.

The Roadsaver 231 was also placed in a transverse crack in the inside asphalt shoulder and in the longitudinal joint for about six to eight feet at MP 331.4. Also, at MP 330.6, a longitudinal crack extending through three panels in the passing lane was sealed with the Crafco product. It was estimated that two applications of sealant would be required to fill the crack; however, only one application was needed.

E. W.R. MEADOWS SOFT-SEAL

W.R. Meadows sealtight SOF-SEAL is a low modulus, hot applied material placed at 380°F. Both the driving lane and passing lane joints were sealed on July 9, 1986. The same melting pot was used for both this product and the Allied Koch which had been placed the previous day. Before heating, the pot was purged and the equipment cleaned out. The backer rod was placed at 1-1/4 inches below the surface of the slab. The crew consisted of a driver and an applicator. Figures 8 and 9 are photos of typical hot-pour placement.

The SOF-SEAL exhibited the same characteristics as the Allied-Koch 9005. It did not flow quite as much, but it still tended to run on the elevated joints. It also bubbled much like the Allied-Koch.

F. LONGITUDINAL JOINTS

The longitudinal joint between the driving lane and passing lane was filled with different materials. On July 8, the contractor placed approximately 340 feet of Allied-Koch sealant in the longitudinal joint from station 6938+80 to 6942+00. On July 9, Crafco placed their product from station 6927+10 to 6938+80. On the same day, W.R. Meadows SOF-SEAL was placed from station 6944+88 to 6945+60.

On July 14, the contractor placed the last of the Dow Corning 888. From station 6944+00 to approximately 6944+80, Superior Products 888 was placed from station 6945+60 to 6946+00. The remainder of the longitudinal joints were filled with Superior 444: station 6926+50 to 6927+10 and station 6946+00 to 6956+50.

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1) Arizona Department of Transportation, "Traffic on the Arizona Highway System 1984", July 1, 1985.

2) F. R. McCullagh and M. D. Souza, "A Five Year Evaluation of Concrete Pavement Joint Sealants", Arizona Department of Transportation, 1984.

3) F. R. McCullagh and M. D. Souza, "ADOT's Joint Sealant Study". Arizona Department of Transportation, 1985.

4) D. K. Stephens, "Joint Sealants", Arizona Department of Transportation, September 1979.

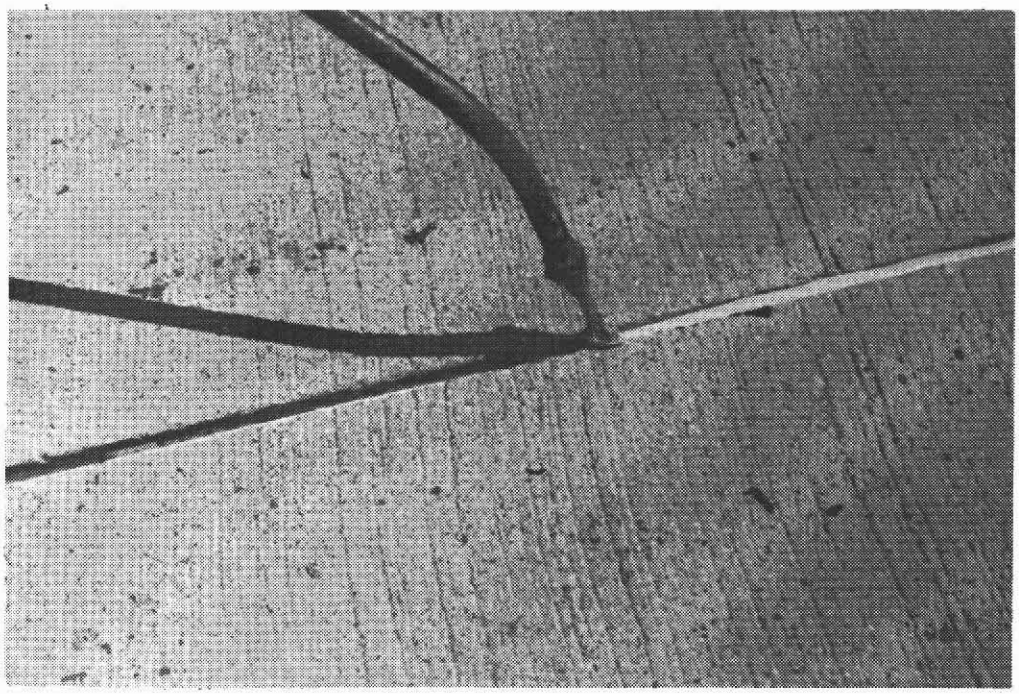

Figure 6- Placement of Silicone Material

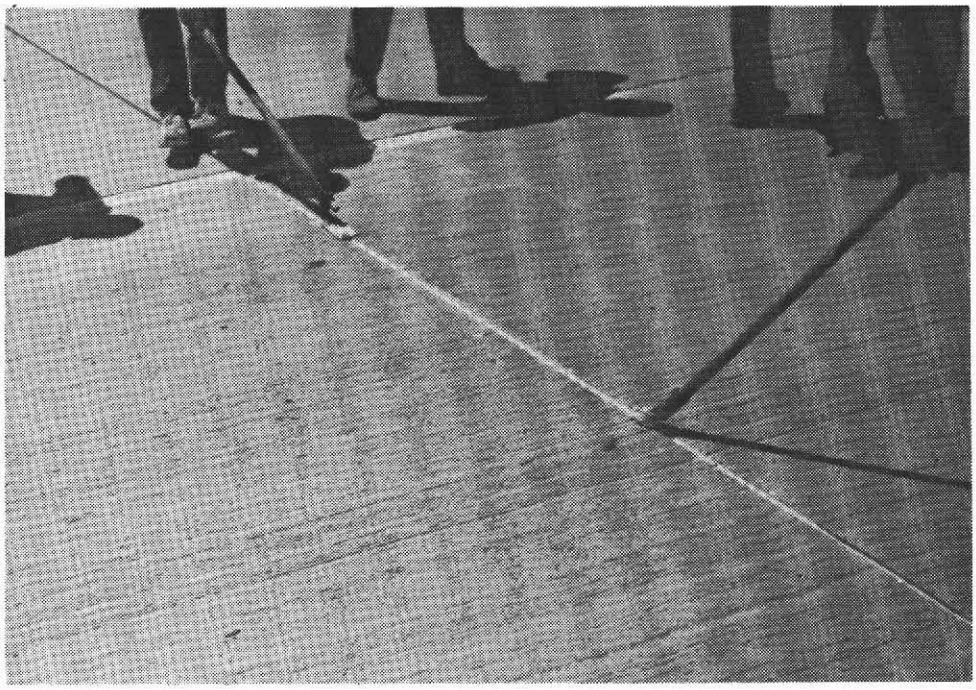

Figure 7 - Tooling Silicone Material

Figure 7 - Placing Hot-Pour Joint Sealant

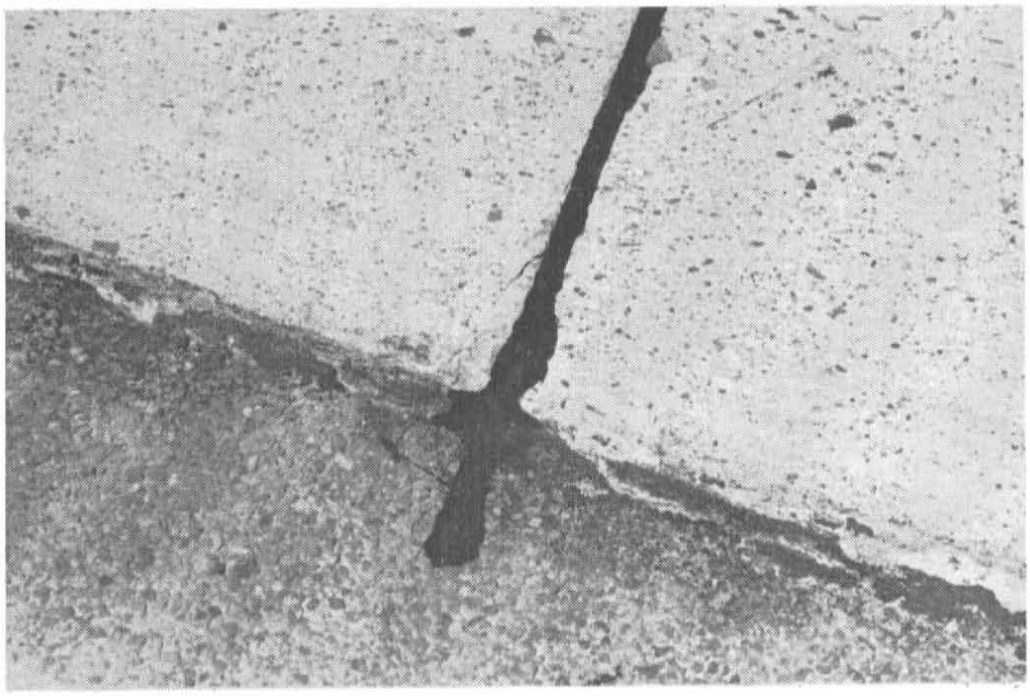

Figure 8 - Typical Hot-Pour Material